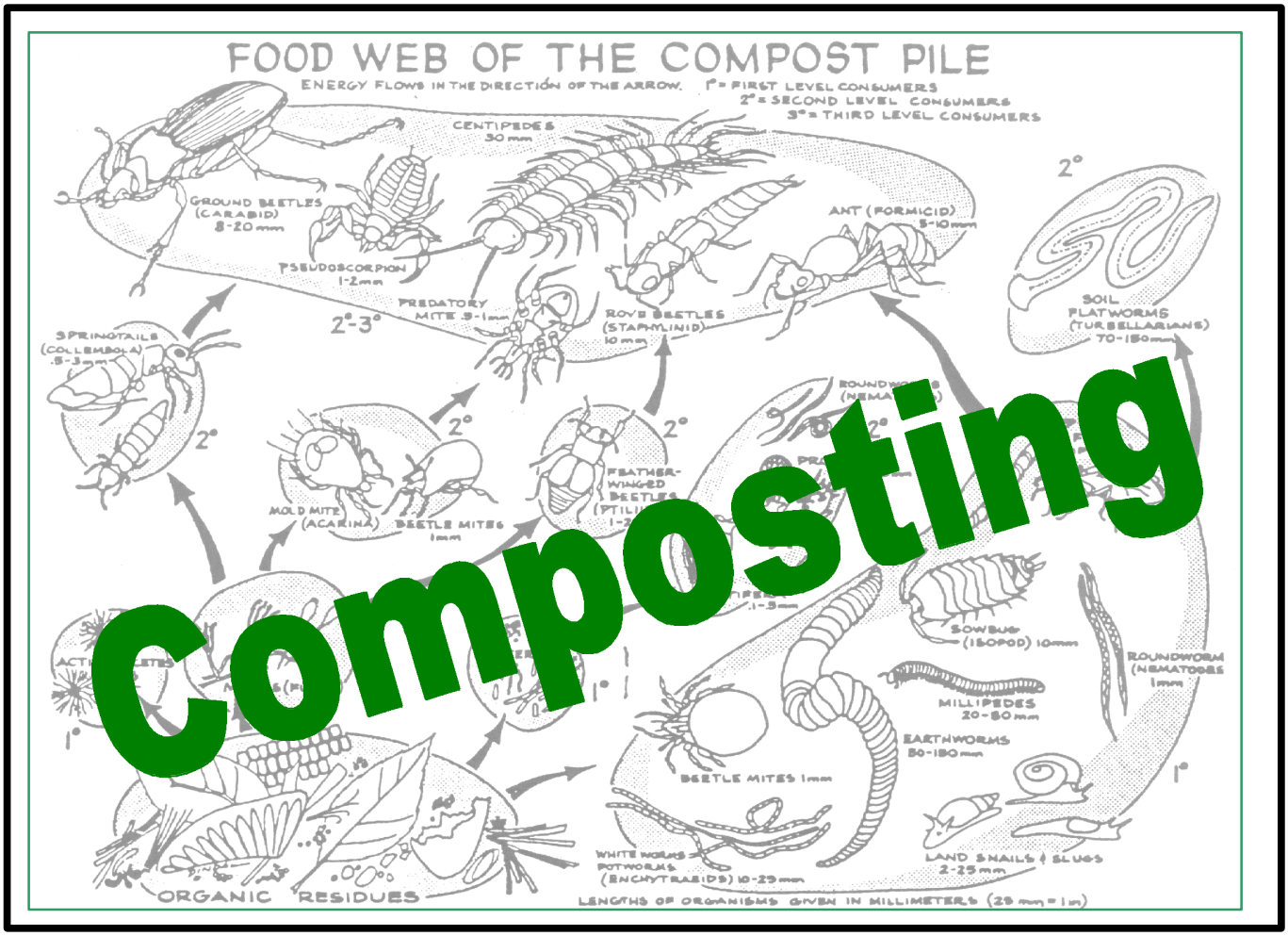
A Guide to



Composting

Illustration from Dindal, 1971, *Ecology of Compost*

IN School

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Why compost at school?

Chances are you're familiar with the concept of composting. For most people, their only experience with composting is in their backyard. With little effort, these techniques used in backyard composting can be easily applied on a large scale and provide many benefits for schools.

Although few opportunities exist for schools to increase educational opportunities while saving money, compost can be one. Composting in schools aids in reducing waste sent to landfills and green house gas emissions from landfill decomposition. This reduction is vital to the preservation of Iowa's natural environment and conservation of natural resources. This guidebook offers a step-by-step look at developing a composting program for leftovers, yard waste, and other organics in schools.

Schools are among the largest institutions generating solid waste. Conservative estimates state that two pounds of waste is generated per student every day. Up to 60 percent of that waste is organic and recyclable.[1] Composting recycles this waste into a usable and salable product, and may result in reduced disposal costs, as well. The following composting techniques and tips can assist any school in starting an environmentally sound disposal program for solid waste

Composting at school teaches students while diverting waste from landfills. School composting can be integrated into the curriculum and provide a real-world and hands-on approach to classroom learning. Composting efforts can effectively be combined with school disciplines of science, math, economics/marketing, and English to enhance curriculums, and provide interdisciplinary applications.

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[1] According to the Minnesota Source-Separated Composting Project (MSSCP) carried out by the National Audubon Society Waste Management and Dakota County in 1995-96, trash removal service was cut more than in half when supplemented with organic recycling at four Minnesota School Districts.

Not every institution implementing a composting operation into their solid waste program will realize immediate savings. Over time, however, the amount of money saved in hauling costs, and hopefully packaging material will add up to quite a significant amount.

Waste Audit

Conducting a waste audit is the quintessential starting point for a composting operation. Before any decisions on the type of composting operation are made, the amount of waste being generated must be determined. Schools have found anywhere from 0 to 75 percent of lunch waste is meat. However, meat can be difficult to work with because of its tendency to attract rodents and flies. Due to such concerns, organic material must be assessed to determine the amount and type of waste generated. This will not only give a good idea of the size of the operation that's needed; it will also help to determine the type of system that will work best.

To conduct a successful waste characterization make sure students, faculty, and cafeteria staff are involved. While a two-week timeframe is preferable, the audit can be done over a one-week period. Simply place special bins for students to scrape their food waste into and have other wastes placed in regular trashcans.

Then weigh the material and average the amount from the one to two week period (appendix 1).

Don't forget about the preparation waste (this is the waste produced before the meal is served including fruit peels, lettuce cores and similar items) when conducting the characterization.

Meat can be difficult to manage in some composting systems, therefore, it is helpful to determine the amount of meat waste going into the bin. Whether this material is collected separately or estimated, that information can be used to determine the type of composting operation utilized. There will also be some nonfood waste going into the bin such as napkins. Also note any unpopular meals and report this back to the cafeteria staff. This may help them in planning meals, ultimately leading to the reduction of waste.

The following chart will help with converting the gallons collected to the cubic feet volume necessary for determining composting

Gallons	**Equivalent Volume**
7 1/2 gallons	1 cubic foot
45 gallons divided by 7.5	6 cubic feet
202 gallons	27 cubic feet

A container that is 3 ft x 3 ft x 3 ft equals 27 cubic feet

Take a look at other activities or classes that may also have compostable materials. For instance, an industrial technology class may have sawdust that can be disposed of in a separate container for composting.

Composting Options

Now that the amount of compostable material has been determined, it's time to take a look at the systems available with which to compost. Luckily, school composting can be done in a variety of ways. Some of those are:

1) utilizing an existing facility,
2) bin systems,
3) in-vessel composting, and
4) vermicomposting (worm composting).

The type of technology utilized is dependent upon a number of factors including cost, amount/type of food and yard waste, available land, and labor required. Another key consideration is the age of the students. Some systems may be more fun for students than others. For example, elementary grades may really enjoy vermicomposting (composting with worms). However, any of these systems can provide an affordable, fun, and hands-on opportunity to teach students while developing a sense of environmental stewardship.

1) Existing Facility-

Don't overlook the obvious. Iowa does have compost facilities accepting food waste. Check out local compost facilities or talk to the solid waste officials in the area to determine if it would be feasible to have the school compostables delivered to an existing compost site. It may also be worthwhile to see if any area farmers are currently composting and would be willing to incorporate food residuals into their mix. Make sure that the facility where the material will be composted has met all state and local regulations and has a good reputation. If so, all that's left is figuring out the logistics.

2) Bin Systems-

These units resemble those commonly found in backyards. The bin needs to be at least large enough for a 3x 3x 3 foot pile. Piles smaller than this won't be able to sustain the high temperatures necessary for good composting. Food waste is added to the bin along with a good bulking agent and carbon source. The unit then stays in the same bin or is turned into another bin until the material has fully decomposed. The unit itself can be constructed from almost any material including wood, wire, concrete blocks, or plastic. Having a lid on the bin will lessen the odor and pest concerns while drawing attention away for the bins.

Bulking agent- Large, dry materials such as wood chips added to a compost pile to increase porosity.

Carbon source- Materials such as leaves, newspaper, and straw.

Nitrogen source- Materials such as food waste, green grass, and manure.

Carbon to Nitrogen ratio (C:N) – The proper mix of carbon and nitrogen that provides a good environment for composting.

In addition to the bulking agent, oxygen is added to the pile through periodic turning or aeration of the compost. This can be done with a pitchfork or similar tool.

Costs	$0-1,000 (material can be donated and construction done in school)
Labor necessary (Level at which students can help)	5-10 hours/week K-12 w/ assistance for younger children
Materials Suitable	Food (note caution), napkins, yard waste, sawdust
Advantages	Easy to maintain Low cost
Disadvantages	Slow (3 months- 1+years for finished product) Meat and dairy products may be difficult to compost well

Caution: Only add meat or dairy to hot piles with proper Carbon/Nitrogen ratio

3) In-vessel composting-

This hi-tech type of composting involves placing material into a manufactured container and sealing the container. By using in-vessel composting techniques, the nuisances of pests,

strong odors, and unsightliness can be avoided. In-vessel composters can transform waste within a few days rather than months. The nice thing about most in-vessel system is that meat can be added in large or small quantities with little to no concern of odors and attracting animals. Check with the dealer of the equipment to ensure that this is the case with their system. Some in-vessel composters can only handle a certain percentage of meat.

Units capable of composting anywhere from 3.5 cubic yards-200 tons/day can be at a cost ranging from a few thousand to hundreds of thousands of dollars making economics the biggest hindrance to this type of composting. Obviously, the type of unit purchased should fit with the site, degree of operational knowledge required, and amount of residuals being produced. While some units are turned by hand others require electricity to mechanically turn the unit. Therefore, space and electrical issues need to be addressed.

Costs (no labor)	$7,000 - $25,000
Labor	5-15 hours/week Technical knowledge needed Levels 5-12 or 9-12 Depending on system
Materials Suitable	Food scraps including meat and dairy (most systems) Yard waste Paper products (non waxy)
Advantages	Fast Capable of composting most organics
Disadvantages	Expense Technical knowledge required Space devoted to system

4) Vermicomposting-

Composting using worms can be done utilizing a variety of technologies and is an especially good way to introduce the idea of composting. Small worm bins can be placed in classrooms and monitored by the students. However, it can also be done on a larger scale and works great for food residuals since the units are again enclosed, therefore, eliminating major odor concerns.

Regardless of the type of vermicomposting system used, the worms must be kept within a defined temperature range between 50-80º F. Therefore, the system works best, especially in Iowa, if inside a building. Pulped food also works great for this system although not

necessary. There are institutional style bins in which material is added to the top of the bin and finished worm castings are removed through a tray on the bottom of the bin. Bins can also be constructed with wood and work in much the same way with a little more manual labor, but much cheaper.

Costs	$ 100 – 25, 000
Labor	K-12 5-10 hours/week
Materials Suitable-	Vegetables, Fruits, Breads, Coffee rinds Avoid large amounts of meat and dairy (if pulped this concern lessens)
Advantages-	Easy to maintain Can be done on a smaller scale in classrooms
Disadvantages-	Expense of commercial devices Temperature Requirements

How to Choose a System

Explore similar projects that have been completed or are ongoing in your area. Others have encountered and solved many of the difficulties in implementing such a program that one might run into. Talking with them and getting their ideas will make the job a lot easier. Talk to schools and institutions in Iowa that compost their waste. See how they chose a composting system and what they like and dislike about their system. Discuss any and all problems that have been encountered and how they were dealt with. Also look at other states to get an idea of how composting in schools has worked there. One of the easiest ways to do this is to call state and local solid waste agencies and get a list of schools or institutions that are composting. Also, call the manufacturers of the compost systems to get the names of any institutions they have worked with.

Don't reinvent the wheel...talk to others

Assess technical skills of staff. Has someone on staff done a lot of composting? If someone on staff already understands composting, they may have an idea of how things should run. Is there a Mr./Ms. Fix-it that might be able to take a look at a mechanized system and make minor modifications as needed? If not, perhaps a simpler system would work better.

Determine any land or building space available for composting. Is there a storage building or basement that could house some equipment for vermicomposting or an in-vessel system? This will become important as technologies are explored. If additional building space is needed to house the composting system, a different technology may be better suited. The economics will be critical, therefore, find an area to work with that will be economically feasible.

The program that works best for one facility may not work for another, so it's important to look into all available options. If the school has an auxiliary building with extra room, they will have different options than a school that is limited, by space or money, to an outside location.

Budget

Not every institution implementing a compost operation into their solid waste program will see significant savings in the first few years. However, over time, those economic benefits will become more noticeable as landfill tipping fees and related expenses are avoided. Initial economic evaluations should quantify, as much as possible, the educational benefits related to composting as much as possible. For example, is there a way to determine the amount of money saved or gained by having an outdoor classroom?

Composting should save money on garbage disposal and fertilizer application (lawn or garden). Expenses incurred will come from labor, and any expenses related to the compost system utilized. Labor costs vary depending upon the system used. Therefore, make sure to figure such needs when determining equipment expenses. Also, consider how much work with which students can and can't assist.

Schools can save up to 60 percent of their waste removal costs through composting. Consultants for the Maharishi School project estimated that students generated an average of two pounds/day of organics. That adds up to an average of 10 pounds of landfill waste/week/ student. For a school having 250 students, this produced 2,500 pounds per week.

Pounds per student/day	Number of Students	Weekly Tons Produced	*Est. disposal $/ton	Weekly Cost for organics disposal ($)	Annual Disposal Costs $ (180 day school year)
2 pounds	0-249	1.25	$40.00	50	1800
2 pounds	250-399	1.25-1.99	$40.00	50-79.6	1800-2866
2 pounds	400-599	2-2.9	$40.00	80-116	2880-4176
2 pounds	600-1,000 +	3-5	$40.00	120-200	4320-7200

*Be sure to get figures from current collection costs. The $40.00 is not applicable to all institutions.

Assuming 60 percent of material is compostable, schools can potentially save anywhere from $1100-4320/ year depending upon the size of school, current recycling programs, and current garbage hauling costs.

Costs of Landfilling:

Average Iowa landfill tip fee costs are: $33/load.

Transportation costs:

These will vary depending upon location and frequency of pickups. However, for preliminary budget calculations the conversion of 500lbs of organics/cubic yard can be used to determine disposal cost/saving.

Additional Savings:

Garbage is often collected daily or every other day in schools. Primarily because of the large amount of food waste and the space they require and odors produced. However, if this waste was diverted from the dumpsters, fewer collections would be required. Therefore, dumpsters could be collected less frequently or if possible only when they are full.

Conservation Potential of Composting School Waste:

The conservation potential for this project can be determined by taking the number of Iowa students in public and accredited private schools: 545,591 students [2] multiplied by two lbs. waste/student/day, for a total of 1,091,902 pounds of school waste/day. This amount multiplied by the number of school days in the year, equals approximately 196,542,360 lbs. or 98,271.2 tons of waste that could potentially be diverted from Iowa landfills by Iowa schools each year.

That's enough material to cover over
1,090 football fields with 1 inch of organic waste.

Involving Staff and Community

Finding others interested in such a project and asking for their expertise as needed not only helps with the development of the project, but will make everyone's job a lot easier. After some of the basic information has been gathered, it is time to get a core group together to work on the project. Having completed some initial groundwork allows everyone to focus efforts as needed on specific topics. This also helps garner support for the project by having a group involved from the beginning. Faculty, parents, and other citizens can bring a great deal of knowledge and ideas to the development of the project. It will also be easier and have more impact to address a school board with numerous people onboard as opposed to one or two people.

[2] Iowa school enrollments are quoted by the state Basic Education Data Surveys (BEDS) on January 25, 1999.

Ask some of these questions when finding people to work on the project.

1) Is there someone who will manage the project and oversee day-to-day operations?
2) Is everyone on the cafeteria staff willing to separate organics from non-organics? If not, will they change their daily routine to incorporate separation if the importance of the project is explained?
3) Is their another school or institution that could partner on such a project?

Possible Team Members
Faculty
Custodians
Cafeteria Staff
Students
Local recycling coordinator
County Conservation Board
Student & Community
Environmental Groups
Parents
Interested Community Members

Potential Partners
Local Schools
Hospitals
Care Facilities
Summer Camps
City Composting Site

Explore the potential for partnering. For example, other schools, nursing homes, or summer camps may want to work with/cost share a project like this. If this type of connection can be made not only will these people be excellent members of a coordination team, the project should become an easier sell. There will be additional food diverted and more labor and financial resources will be available.

Garnering Support from the School Board and Public

Although this is probably old hat for educators and other school employees, presenting to the school board and the public will be critical in garnering support for the project. The following is a list of things to have ready for the big moment.

- Talk about how other institutions went about this process and how this may fit into your institution. Providing examples allows other to see that this project can work.
- Explain how food waste is currently managed at the school.
- Have information on the amount of material currently being recycled and the increase that composting would provide.
- Show how the project will be a natural addition to the school.
- Bring in educators or members of the coordination team who can reinforce the idea that such a project would fit well into their curriculum.
- Have area parents/residents sign forms or write letters of support showing their support for this project.
- Prepare economic information including additional staff time.
- Secure the usage for land or building necessary for the implementation of the project
- Prepare a timeline/work plan for the project.

How to Implement Waste Separation and Begin Compost Operation

1) Lunchroom Food Waste Tips
Signs and containers for collection should be placed next to tray and dish collection sites. Older students can serve as monitors and a schedule of the names of student monitors can be posted in the lunchroom. The job of the monitor is to watch collection containers and see that only organic and non-organic waste goes into the respective containers.

2) Yard Waste Collection
Yard waste will be very beneficial in ensuring a good composting operation, especially dried leaves that will contribute to the carbon content of the compost. Therefore, keep a pile of leaves around at all times. Leave can be placed in a separate bin close to the rest of the compost. Also talk with city officials and see if there's a possibility of obtaining some chipped wood from them (a good bulking agent).

3) Basics

- The composting site will have to meet all state regulations. These regulations can be found through the Iowa Department of Natural Resources- Waste Management Assistance Division at www.iowadnr.wmad.org or by phone at 515-281-8308 (appendix 2).

- Bins should be between 20-64 gallons for organics collection. Anything over 64 gallons becomes too heavy and removal is next to impossible. 40-gallon bins have proven to be successful in grocery stores that are recycling their food residuals. Using the smallest size bin possible will save lots of backache and help sustain enthusiasm for the project.

- Certain materials such as plastics will inevitably become a problem with composting food residuals. Look at ways of reducing the amount of plastic or packaging in general that is used in the cafeteria. This not only helps in recycling, it also meets the goal of the 3 R's **Reduce, Reuse, and Recycle**.

- Give exact direction for what does or doesn't go into the compost bins. Have a list posted nearby the bins and continually educate students through various awareness methods as to what is and is not acceptable.

4) Begin Construction of Compost Operation

- Check with the proper personnel regarding any alterations needed on site.
- Depending upon the technology used, ensure a technician will accompany arrival of equipment.

- Have equipment arrive during opportune times of the year. Summer might be nice because it allows for staff to become familiar with the process and work out any bugs before students arrive.
- Place someone in charge of facility that is available to work and oversee operations at the site once it's up and running.
- Prepare for the collection food residuals.
- Purchase bins.
- Educate staff on collection, separation, and emptying of bins for organics.
- Develop a program to educate students about the above issues.
- Determine who will monitor bins.

Managing Compost

Knowing a few things about compost will help with troubleshooting and development of a good system. Monitoring feedstocks, odor, temperature, and moisture will help things run smoothly.

Getting it Right!

No matter what system a school decides to use, there will be some level of experimentation needed. Compost involves living things and the environment they live in must be suitable to them. It takes a certain recipe for composting to be successful. Food waste is high in nitrogen, while dried yard waste, sawdust, and paper are high in carbon. A carbon to nitrogen (C/N) ratio of around 30:1 is considered ideal for compost. However, C/N ratios far from this have proven to work with many composting operations. Therefore, experimentation is needed to calculate the right mix. A bulking agent will also be needed. The bulking agent provides adequate air pockets for oxygen get into the pile. Wood chips are the most popular and oftentimes easiest bulking agents to obtain. In total the proper mix of nitrogen, carbon, and bulking agent will need to be found that allows for successful compost of the material. The willingness and patience to experiment until the proper recipe is found is necessary in order to create usable compost (appendix 3).

Feedstocks-
In order to correct any problems that may arise or to help determine the proper recipe, make sure to record when, what, and how much material is added. Also include information on when piles are aerated or moisture is added (appendix 4).

Temperature-
Once the proper mix of nitrogen, carbon, and bulking agent are mixed into a compost pile, things will begin to heat up (appendix 5). In order to take the temperature of the pile, purchase a temperature probe with a 3-foot end. Temperatures should be taken and recorded, daily if possible, at depths of 1 and 3 feet approximately half way up the pile. Appendix 3 provides a model for proper temperature recording. Depending on the ultimate use of the compost and system being used, the time temperatures are required to stay high enough to kill weed seeds and pathogens will vary. Discuss temperature requirements with the equipment manufacturer or compost specialist in the area.

Odor-
This is the easy one. Develop a rating scale for odor (appendix 4). This can be as simple as good/poor, or have a number of odor descriptions to choose from. Then pay attention and monitor odor change or consistency when approaching and/or working with the compost.

Properly managed compost smells good!!

Moisture-
Although moisture can be measured scientifically, it's usually more practical to simply touch the material and make an assessment. Grab a handful of compost and squeeze. Then record, using a predetermined rating scale, how wet the material is. Usually people use dry, good, and wet as indicators. If the material crumbles or drips with water the moisture level is respectively too low or too high. At the proper level, the compost will stick together and leave the hand moist.

Fitting the Project into Current Curriculum

Do faculty and administration support the composting efforts and are they willing to assist in promotions and motivation? Work with them to incorporate a composting project into school activities and curriculum. Assist them in realizing potential incentives (appendix 6).

Educational/Social Incentives-
The educational opportunities available through school composting are enormous. The following will help illustrate some of the educational and social opportunities gained through composting.

Science:

Air Quality-

Methane is a harmful greenhouse gas that is produced under anaerobic (no oxygen) conditions in a landfill. Composting, however, can aid in decreasing the nearly 1 percent annual increase in the atmospheric methane levels.

Microbiology-

What give soil that "earthy" smell? Actinomycetes

Fungi, bacteria, actinomycetes, and a host of other organisms are found in a compost pile. Each of these organisms peak at different stages and specialize in digesting different materials.

Water Quality-

Organics become unstable once they enter a landfill. Leachate, a substance capable of rendering groundwater undrinkable, is produced as organic materials decompose in landfills.

Soil Quality-

In addition to the above, compost is the equivalent humus. Humus is the dark, rich, organic part of soil. Therefore, many aspects of soil, from fertility to biology, can easily be illustrated.

Solid Waste Management-

Organics represent approximately 46 percent of landfilled materials in Iowa. Composting this material helps bring home the concepts of consumer responsibility, recycling, and etc.

Economics/Marketing:

An economics class can easily take part in determining the economics of the composting project. Turn exploring the idea of school composting into a class project. This immediately allows students the opportunity to become involved in the process while offering a real life learning experience.

Finished compost can be marketed and sold to the community for a class, fundraiser, or similar activity.

Mathematics:

Volumes and a variety of other calculations can be made from a compost pile. From the most basic to advanced mathematics, all types of questions can be challenged.

Vocabulary

Bacteria - microorganisms that help in decomposition

Compostables - organic materials that can be broken down into humus by microorganisms

Decomposition - breaking down - The breaking down of organic matter such as leaves, apple cores, straw, and potato peels is done by many living creatures.

Fungi - simple plants that have no chlorophyll. These include mushrooms, molds, and mildews

Macroorganisms - creatures that we can see with the naked eye, including earthworms, mites, grubs, and insects

Microorganism - a small plant or animal that you can see only with a microscope

Nutrients - substances that provide a source of energy for the growth and repair of living things

Organic - material that comes from a living thing such as grass, vegetables, fruits, trees, straw, food scraps, etc.

Oxygen - a colorless, odorless chemical element, usually in gas form that is essential for life.

Resources

Department of Natural Resources, Waste Management Assistance Division, Wallace State Office Building, Des Moines, Iowa 50319 – technical assistance &grants for composting projects: Phone: 515-281-8308 or 515-281-8941
Web site: http://www.state.ia.us/dnr

Iowa Recycling Association, 2742 SE Market Street, Des Moines, Iowa 50317
Phone: 515-265-1596

BioCycle Magazine - *BioCycle Journal of Composting and Recycling* provides information on all aspects of composting including the latest in scientific findings and composting projects. The JG Press, Inc. 419 State Ave, Emmaus, PA 18049, 1-800-661-4905, http://www.jgpress.com

U.S. Composting Council - P.O. Box 407, Amherst, OH 44001-0407, Phone: 440-989-2748, Fax: 440-989-1553, http://www.compostingcouncil.com

Maharishi School Demonstration Composting Project for Iowa Schools, 804 North Third St., Fairfield, Iowa 52556-2203 Phone: 515-472-9400 extension 5057
Web site: http://www.mum.edu/maharishi_school

Demonstration Composting Project for Iowa Schools web site at: http://www.geocities.com/Eureka/Plaza/7204/ This web site outlines the complete two-hour presentation on the *Demonstration Compost Project for Iowa Schools*.

Appendix 1. Waste Audit Data Collection Form

Day	Compostable Food Waste (lbs.)	Percent or Weight of Meat	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Totals			
Average			

Appendix 2- Permitting and Sale of Compost

Value of Compost as a Marketed Product

Compost is a product with a nearly limitless market. Nurseries, landscapers, gardeners, and organic farmers all want compost. In Fairfield, Iowa, the site of Maharishi School's demonstration school composting project, one local nursery sells 24,000 40 pound bags of compost for each growing season. At $4.00/bag, the amount of income from compost sales equals $96,000. Bulk compost in the Fairfield, Iowa area sells for $16/cubic yard delivered. Both of these examples demonstrate the value of compost as a marketed product.

Potential Compost Markets:

Lawn Service companies
Groundskeepers of institutions
Landscapers
Nurseries
Golf courses
Greenhouses
Fruit and vegetable growers
Gardeners
State departments of transportation
County and city parks
Tree farmers
Topsoil marketers

Compost Permit

Application must be made to the Iowa DNR for a composting site permit including food residuals.

Apply to:

Paul Lundy
Iowa Department of Natural Resources
502 East 9th Street
Des Moines, Iowa 50319-0034
Fax #: 515-281-8895
Phone: 515-281-8912
Paul.Lundy@dnr.state.ia.us

Application for Disposal Project Permit

Each compost site must apply for a Disposal Project Permit. Call the DNR and request an application Form 50 #(542-1542) or go to http://www.iowadnr.wmad.org/ for the form. A licensed engineer must agree to do an annual site inspection. A local county engineer may agree to perform this inspection.

Each permit lasts 3 years and is then renewable for another 3 years. The cost of a permit is free to the applicant.

Sale of Compost

Compost can't be applied to land, sold, or given away in Iowa unless the concentration of human-made inert materials such as glass, metal, and plastics, is less than 1.5 percent by dry weight and any human-made inert materials are less than 23 millimeters. In order to meet this requirement compost will most likely need to be screened. Contacting a facility in the area with these capabilities should solve any problems with this requirement.

Compost Testing

Before selling compost, it must be tested for nitrogen (N), phosphate (P), and potassium (K). Testing cost is about $30. Food storage type plastic baggies filled with sample is sufficient for testing. Call before sending the sample to confirm the cost at each facility.

The following are laboratories that test compost:

1. National Environmental Testing, Inc., Cedar Falls, IA 319-277-2401

2. Midwest Laboratories, Omaha, NE, 402-322-7770

3. Iowa Testing Laboratories, Inc.
P.O. Box 188
Eagle Grove, Iowa 50533-0188
515-448-4741

Registration of Compost for Sale

After being tested and before compost can be sold, application for and registration of the product must be sent to the Department of Agriculture and Land Stewardship.

Address:
John Whipple
Fertilizer Bureau
Des Moines, Iowa 50319
Phone: 515-281-8599
john.whipple@idals.state.ia.us

Cost of registration and application is $10.00

Bagged compost must have a label stating the testing information, the source of the compost and the name of a responsible person for the product. Bulk compost must have an accompanying paper for the consumer with the same information.

Appendix 3- Troubleshooting

The following guide can be used to determine the causes of most problems. Be sure to refer to monitoring records when problems do arise. They may be helpful in determining the cause of the problem.

Problem	**Solution**
Smells like rotten eggs (sulfur)	Add more air to the mixture by aerating or adding more bulking agent
Smells sour (like ammonia)	Add more carbon (leaves, sawdust) to the mixture
Mixture is dry	Add water and turn
Mixture is too wet	Aerate the pile daily until pile returns to the proper level
Mixture doesn't heat up	Add more nitrogen (food waste, green grass, manure, etc)
Mixture attracts animals	Keep animal products separate or consider enclosing the system
Mixture attracts flies	Keep composting materials covered

Appendix 4. Record keeping

The following was adapted from Anamosa State Penitentiary's compost facility

Pile Temperature Monitoring Record

Bin Number_____
Date Started_____
Ingredients/Comments_____
_____
_____
_____

Date	Time	Moisture Rating	Odor Rating/Smell		Temperature (°F) 1 feet	3 feet

Moisture Rating

1- High Moisture, compacts easily, water runs out
2- Moderate moisture, compacts easily, able to get moisture out of sample
3- Average moisture, will not compact but feels moist
4- Below average moisture, will not compact, little if any moisture
5- Dry, no moisture noticed, falls apart, possibly producing dust

Odor Rating

1- No odor
2- Small amount of odor detected when standing next to the bins
3- Average amount of odor detected when approaching the bins
4- Above average amount of odor detected when approaching the bins
5- High amount of odor detected when a reasonable distance from the bins

Odor Smell-Silage, Pleasant, Musty, Foul, Ripe

Appendix 5- Turning Your Spoils nto Soils -*Building A Hot Compost Pile*

Building A Hot Compost Pile

Hot Piles are useful for mixing vegetables, foods, and yard waste together to produce compost in a shorter period of time.

-Gather all the materials needed to make a pile that is at least three feet cubed. Use both green and brown materials to approximate the 30:1 carbon to nitrogen balance.

-To increase surface area, chop or shred materials.

-Start building the pile with a four to six inch base of carbonaceous material.

-Next add a four to six inch layer of high nitrogen materials. If the greens are not very fresh, sprinkle on a small amount of blood meal or cottonseed meal, poultry manure or another high nitrogen sourc Food wastes may make up a part of this layer. (High nitrogen wastes such as fresh grass clippings or food should be used in thin layers). Mix the green layers together so bacteria can feed on both simultaneously.

-Continue alternating and mixing layers of green and brown materials, adding water and extra Nitrogen as needed, until the pile is three to four feet high.

-Close bins or cover pile, and wait.

-Monitor temperature in the interior of the pile on a regular basis. It should peak between 120-160 degre Fahrenheit.

-Continue monitoring the temperature in the pile.

-About one week later, the temperature should peak. Turn/aerate the pile again. After another week, the compost should be finished. Hot piles without food wastes do not need to be turned, and will be finished composting in three to four months.

Appendix 6- Benefits of Compost Use

Benefits of Compost Use-

Why do we want compost? Compost greatly improves soil quality. It adds chemical, physical, and biological characteristics to soils and other growing mediums. As well as being a natural fertilizer, compost contains water-soluble nutrients in a form that is released slowly to the roots of plants. This allows plants to utilize the nutrients in the most beneficial manner to form plant structures.

1. Improves the soil structure, porosity, and density thus creating better plant root development. Plant roots can easily spread out through light, aerated soil.
2. Increases infiltration and permeability of packed heavy soils and reduces erosion and soil runoff.
3. Improves water holding capacity, thus reducing water loss and leaching in sandy soils
4. Supplies a variety of macro and micronutrients
5. May control or suppress certain soil-borne plant pathogens.
6. Supplies significant quantities of organic matter
7. Improves the cation exchange capacity of soils thereby improving their ability to hold nutrients for plant use
8. Supplies beneficial microorganisms to soils and growing media
9. Improves and stabilizes soil pH.
10. Can bind and degrade unwanted soil pollutants.

Returning organic waste products to the soil will put back what has been removed from the soil by years of bulldozing, chemical gardening and farming, plowing, and overgrazing. Soil is the basis of our state's food production. By returning composted material to the soil, we build up what has been torn down by decades of unwise soil management.

Appendix 7- *Maharishi School Demonstration Composting Project*

Project Description
In May 1999, the Iowa Department of Natural Resources funded a model demonstration school-composting project at Maharishi School in Fairfield, Iowa. Maharishi School is a K-12, private school that enrolls about 500 students. The project composts leftovers from the school lunchroom to produce a marketable product for sale to the public.

The project used an in-vessel composting unit #408 from B.W. Organics. About 200 pounds of food waste from the school lunchroom, plus carbon (leaves, straw, wood chips, etc.), can be fed into the unit each day and composted material removed daily from the unit to maintain a constant volume in the unit. The unit is most efficient at 2/3 capacity.

For schools that wish to implement a similar project, the following points are tips gained from practical experience with this project.

Equipment Setup
The composting units from B.W. Organics need space under a roof. The #408 unit requires about 36 feet by 30 feet. This provides workspace and a storage area for carbon sources so they stay dry. If it is desired to unload material from the tumbler directly into a manure spreader, additional space is required. The material unloaded is composted sufficiently to be used as mulch. However, if finished compost is desired, the material requires a space indoors or outdoors where it can be piled or windrowed for approximately six months to cure.

Larger units require proportional "under roof" space. Both 110 volt and 220 volt electrical hook ups are required. The composting unit has four electric motors: one for the Patz chopper which chops and mixes food with the carbon source, one for the auger that feeds chopped materials into the tumbler, one for the tumbler, and one for the conveyor belt which moves unloaded materials into a manure spreader or other container. To meet state safety standards, all motors except the tumbler motor must to have cutoff switches installed. A qualified person must do the initial setup. This requires one to two days of work with about $350 in additional materials. A water supply nearby is needed to clean processing equipment. The water supply must be kept from freezing.

Every three months a maintenance check and lubrication of the equipment is recommended. This requires about half an hour to check belts and oil and grease the moving parts.

In order to sell the compost, a permit must be acquired from the DNR . Daily records of wastes composted are needed to complete tonnage reports for local and state agencies. Also records help in trouble shooting. The record sheet needs to provide space to record date, amount and type of food waste, amount and type of carbon source, temperature of compost, air temperature, amount of compost unloaded, and comments. Tonnage reports require

amount of composted materials in weight. If materials are measured by volume, the average weight per unit volume should be measured and recorded so volume can be translated into pounds. If wood chips are used as a carbon source and the compost is to be sold, the cured compost will require screening.

About 25 percent by weight or 60 to 75 percent by volume of the raw materials composted must be a bulking agent. The exact amount will vary depending on the carbon source used and the moisture content of the food and carbon source. If the final mixture is too wet, add more dry carbon source. Wood chips and leaves are good carbon sources. Wood chips fluff the mixture so that aeration is adequate for proper aerobic decomposition. Without wood chips, food waste mixed with leaves or straw have a tendency to compress allowing anaerobic decomposition to begin.

Troubleshooting

Composting is like cooking. If you don't mix it right and monitor it, it will produce undesirable odors and leachate during the composting process. The proportions found to work well for the food waste produced in Maharishi School cafeteria are: twice as much wood chips and leaves as food waste plus about one part sawdust for 10 parts additional carbon source to absorb excess moisture.

For more information on this project contact Maharishi Schools: Telephone 515-472-9400 or visit their website at http://www.mum.edu/maharishi_school

A comprehensive Troubleshooting and Management Guide can be found in the On-Farm Composting Handbook, Northeast Regional Agricultural Engineering Service, 152 Riley-Robb Hall,Cooperative Extension, Ithaca, NY 14853-5701.